

AN EFFECTIVE METHOD FOR REDUCING BELLY-BURSTING IN FROZEN OIL SARDINES

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A dip treatment in 15% sodium chloride solution for 30 minutes prior to freezing was found to be effective in reducing belly bursting occurring during freezing and thawing of oil sardines. The effect of size and fat content of sardines on belly-bursting phenomenon and storage characteristics of brine treated sardines have been studied.

INTRODUCTION

In spite of being the most important fishery of the country, sardines do not figure much either in the export or internal trade in India. Only a very small fraction of the fish reaches the fresh fish markets and balance is either processed for fish oil and guano or used straight as manure. Canning is done on a very limited scale exclusively for certain internal markets, but the freezing industry is not able to utilize this fish. An appraisal of the problem reveals that high incidence of belly-bursting occurring in this fish is mainly responsible for this condition. On ice storage or after freezing and thawing the belly walls break and the visceral portions protrude out reducing the consumer acceptability of the fish even though other organoleptic qualities are not affected by this phenomenon. The studies reported in this paper deal exclusively with this

problem and provide a simple method for controlling this phenomenon in the fish.

MATERIALS AND METHODS

The sardines (*Sardinella longiceps*) required for the experiments were collected from the fishing boats operating off the coasts of Cochin. On reaching the laboratory, the sardines were washed well and then dipped in solutions of sodium chloride of different concentrations for different lengths of time. After dipping, the sardines were taken out from the salt solution, packed in trays, glazing water added and frozen to -15 to -20°C in contact plate freezer. Untreated control samples of sardines were also frozen in the same way. The frozen individual blocks of sardines were then allowed to thaw at room temperature ($28-31^{\circ}\text{C}$) and after thawing the belly-bursting was noted and salt absorption and organoleptic quality were studied.

The frozen glazed sardine blocks (untreated and dipped in 15% brine for 30 min.) were also packed in 2.5 cm thermocole insulated plywood boxes (tea chests) and stored at room temperature (25-30°C) simulating the conditions of long distance transport of fish (Perigreen, 1968). The fish after thawing in the insulated box after 4 days of storage were examined for belly-bursting.

The frozen samples of untreated and brine treated sardines (15% brine for 30 min.) were stored at -15°C and storage characteristics studied.

The salt content in the muscle of sardine was determined after thawing by the method of A. O. A. C. (1960) and fat content by extracting the dried muscle with petroleum ether (40 - 60°C) in a soxhlet. The free fatty acid and peroxide value were determined by the methods of A. O. C. S. (1946) and Lea (1952) respectively.

RESULTS AND DISCUSSION

The effect of dipping sardines in different concentrations of salt solution on belly-bursting, salt absorption and organoleptic quality is shown in Table I. It is evident from the table that a dip in 10% brine for 60 min or 15% brine for 30 min is enough to bring down the percentage of belly-bursting from 15 - 17 to 3 - 5. The salt absorption is comparatively low and the sardines on cooking in water had only slight saltish taste. Hence for the purpose of dipping 15% brine is used throughout the experiments and the dipping time was fixed as 30 minutes.

Table II shows the extent of reduction in belly-bursting due to the brine treatment in the case of sardines of different size grades and fat contents. The size and fat content of sardines appear to have significant effect on the extent of belly-bursting. Small size sardines which con-

tained less amount of fat showed more belly-bursting. In the case of small size sardines the belly portions are comparatively soft and hence show more belly-bursting. But bigger sizes of sardines having very high fat contents, showed less belly-bursting during freezing and thawing. This can be attributed to the fact that the belly walls of the fully matured sardines are quite firm so that there is less chance of rupturing during the freezing process. The salt treatment besides reducing the belly-bursting to a considerable extent, gives a better appearance and firmer texture to the sardines.

The data on the belly-bursting in different size grades of frozen oil sardines (untreated and brine treated) packed in 2.5 cm thermocole insulated plywood boxes and stored at room temperature

TABLE I EFFECT OF BRINE TREATMENT ON BELLY-BURSTING, SALT ABSORPTION AND ORGANOLEPTIC QUALITY OF OIL SARDINES.

Av. Wt. of sardines 14 gms. Fat content 10.02 D. W. B. Belly bursting before freezing - Nil.

Concn. of brine %	Dipping Time in minutes	Salt content of muscle after freezing and thawing % (Original weight basis)	Belly-bursting after freezing and thawing %	Organoleptic quality after cooking in water.
0	0	0.1988	15-17	No saltish taste.
10	30	0.52,19	6-7	Very slightly saltish
10	60	0.7241	4-5	Slightly saltish
15	30	0.7003	3-5	-do-
15	60	1.066	5	Moderately saltish
Saturated	30	1.201	4	-do-

TABLE II RELATION BETWEEN SIZE GRADE, FAT CONTENT AND BELLY BURSTING OF OIL SARDINES (CONTROL AND BRINE TREATED) AFTER FREEZING AND THAWING.

Concn. of brine : 15%
Dipping time : 30 min.

Wt. of sardines gm.	Fat content % on D.W.B.	% belly-bursting after freezing and thawing.	
		Control	Brine treated
13-15	10-13	15-16	4-5
20-23	19-22	6-8	0 to 2
35-40	40-44	nil	nil

TABLE III BELLY-BURSTING IN DIFFERENT SIZE GRADES OF FROZEN OIL SARDINES (CONTROL AND BRINE TREATED) PACKED IN 2.5 CM. TAERMO-COLE INSULATED PLYWOOD BOX AND STORED AT ROOM TEMP (25-30 °C)

Size of container 30 cm³
Concn. of brine 15%
Dipping time 30 min.

Av. wt. of sardines gms	Fat content % on D.W.B.	% Belly-bursting after thawing in insulated box (after 4 days)	
		Control	Brine treated
15	13.02	20-26	7-10
22	20.58	10-12	3-5
35	41.24	3-5	Nil

TABLE IV STORAGE CHARACTERISTICS OF FROZEN OIL SARDINES (CONTROL AND BRINE TREATED) AT 15 - °C.
Av. wt. of sardine : 16 g; Fat content : 13.08 DWB. Concn. of brine : 15%
Dipping time 30 min.

Storage period weeks	% belly bursting after thawing		P. V. ml. N/500 thio/g Fat		F. F. A. as oleic acid %		Organoleptic quality	
	I	II	I	II	I	II	I	II
	0	14	6	2.68	3.02	2.30	2.12	Good
4	17	4	18.18	16.02	4.01	3.41	„	„
8	14	4	24.70	28.18	7.88	8.60	„	Fair to good
12	16	6	53.63	62.11	11.08	13.08	Fair to Good	Fair
15	16	4	60.14	73.76	12.00	14.12	Fair	Fair to poor
18	14	4	71.06	87.55	15.63	18.74	Fair to Poor	Poor.

I = Control

II = Brine treated

simulating the condition of long distance transport of fish (Loc. cit.) are given in table III. It can be seen from the table that in the case of frozen sardines packed in the insulated box (30 cm³), the percentages of belly-bursting after thawing are comparatively higher than those in table II. This is because when frozen sardine blocks are packed in the container one above the other considerable amount of pressure is exerted on the sardiness especially at the bottom layers causing more belly-bursting.

But when a single sardine block is allowed to thaw in air at room temperature pressure exerted on the sardine is comparatively very low and hence shows less belly-bursting.

The storage characteristics of the untreated and brine treated oil sardines frozen as glazed blocks and stored at -15°C are given in table IV. During the first 4 weeks of storage there was no difference between the control and brine treated

samples in chemical and organoleptic qualities. But after this period the brine treated samples were slightly inferior to the untreated samples. The peroxide values of the brine treated samples were higher than those of control samples. This may probably be because the salt present in the brine treated sardines accelerates the development of rancidity during storage. The frozen storage period had no effect on the rate of belly bursting in untreated and brine treated sardines.

SUMMARY

A dip treatment in 15% sodium chloride solution for 30 min. prior to freezing was found to be effective in reducing belly-bursting occurring during freezing and thawing of oil sardines. The size and fat content of oil sardines appear to have significant effect on the extent of belly-busting. Small size sardines which contained less fat showed maximum belly-

bursting. The brine treatment besides reducing the belly-bursting to a considerable extent gives a better appearance and firmer texture to the sardine.

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